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07 Feb 01
(00 POI)

STUDENT HANDOUT

CONCRETE BLOCK

1. Purpose: The purpose of this period of instruction is to provide you with the basic knowledge and skills needed to lay concrete block.

2. Learning Objectives:

a. Terminal Learning Objective(s):

(1) Provided a mission, construction site, specifications, concrete block, mortar mix, engineer masonry and carpentry tools, appropriate power tools, power source, and references, construct concrete block structures to conform to design specifications per the references. (1371.01.09)

b. Enabling Learning Objective(s):

(1) Without the aid of references, provided a mission to construct concrete block structures, specifications, a masonry tool kit and carpentry tools, select the proper tools to complete the mission per the specifications. (1371.01.09a)

(2) Without the aid of references, provided a mission to construct concrete block structure, specifications, raw materials and tools, mix mortar meet the specifications. (1371.01.09b)

(3) Without the aid of references, provided a mission to construct concrete block structures, specifications, mixed mortar, tools and a construction site, lay concrete block to meet the specifications. (1371.01.09c)

(4) Without the aid of references, provided previously laid concrete blocks and tools, strike mortar joints to produce a finished, water tight joint. (1371.01.09d)

OUTLINE

1. CONCRETE BLOCK MASONRY UNITS:

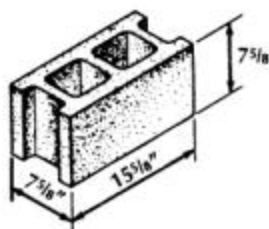
a. Uses. Concrete blocks are used in all types of masonry construction, such as:

(1) Exterior load bearing walls (both below and above grade).

- (2) Interior load bearing walls.
- (3) Fire walls, curtain walls.
- (4) Partitions and panel walls.
- (5) Backing for brick, stone and other facings.
- (6) Fireproofing over structural members.
- (7) Fire-safe walls around stairwells, elevators, and enclosures.
- (8) Piers and Columns.
- (9) Retaining walls.
- (10) Chimneys.
- (11) Concrete floor units.

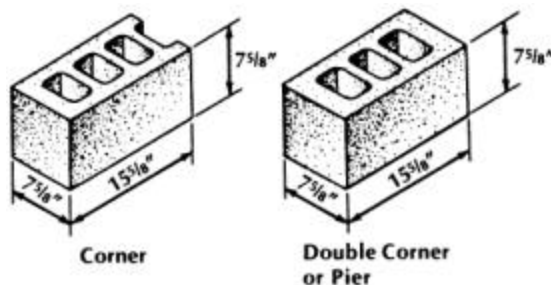
b. Types of units. The main types of concrete masonry units are:

(1) Stretcher block: Are the most commonly used block, used for almost all-general block construction.



Stretcher

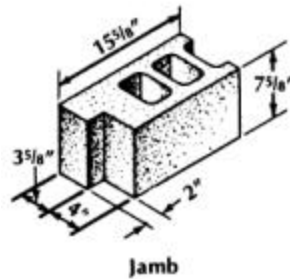
(2) Corner block: Are used for corners and openings. Comes with one smooth end or with both ends smooth



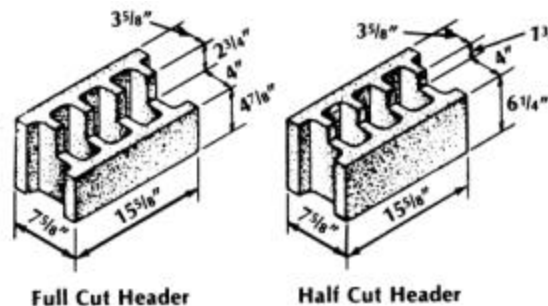
Corner

**Double Corner
or Pier**

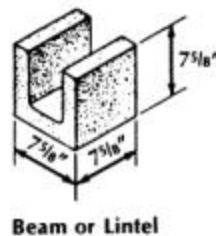
(3) Door jamb block: Used around door openings when metal doorjambes are used.



(4) Header block: Used around the tops of doors and windows. Comes in full-cut and half cut versions.



(5) Bond or Lintel block (shallow and deep): Used when horizontal reinforcement is required. Lintel blocks are also used as headers for windows and doors.



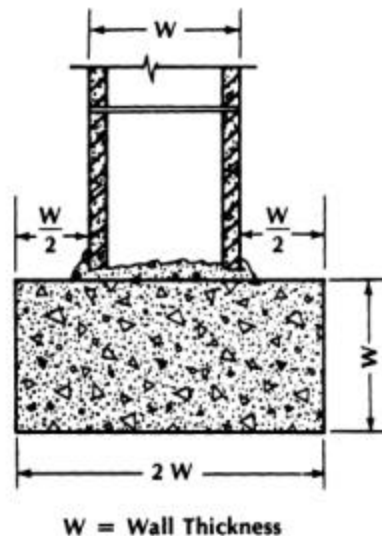
Whichever purpose this block is used for it will always have two reinforcement bars placed in it and be filled with concrete as shown below.

c. Size and shapes. Concrete masonry units are available in many sizes and shapes to fit different construction needs. Both full and half-length sizes. Because concrete block sizes usually refer to nominal dimensions, an 8x8x16 inches unit actually measures 7 5/8 x 7 5/8 x 15 5/8 inches. When laid with 3/8 inch mortar joint, the unit will occupy a space exactly 8x16 inches. Before designing a structure, contact local manufacturers for their available unit sizes and shapes.

2. SIGHT PREPARATION:

a. Foundations: There are two types of foundations that are used and certain specifications should be considered.

(1) Concrete Footer: Width should be 2x the width of the block used and the thickness of the footer will be the same as the width of the block used or a minimum of 10 inches as seen below.



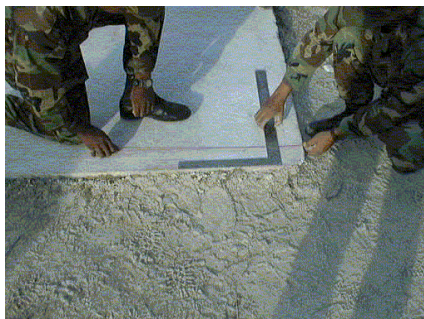
(a) Footings will be placed on, undisturbed soil having adequate load bearing capacity to carry the design load, and below frost penetration.

(1) Concrete Slab: The slab will be constructed with a footer in its design following the rules for footers below. This will cause the slab to be larger than the structure.

(a) Slabs will be placed on, undisturbed soil having adequate load bearing capacity to carry the design load.

b. Layout

(1) Mark and square the corners using the 3-4-5 method or the diagonal method which were discussed in Wood frame construction. Use a chalked snap line and Carpenter's Square to mark the footing so that the blocks can be aligned accurately.



(2) Dry lay the first course of block to establish your Bond, the Bond is the layout pattern that will be used in each course. The pattern or Bond will be reversed on each course to ensure that the joints are offset for greater strength.

(3) Cutting Block: To get your joints to offset you may need to use half blocks. If manufactured half blocks are not available it may be necessary to cut existing blocks to fit. This is done using a bolster and a masons hammer

(a) A bolster is used to cut masonry units into parts a typical chisel is 2 1/2 to 4 1/2 inches wide.



(b) The Mason's Hammer is used to split and rough-break masonry units. The mason's hammer has a square face on one end and along chisel peen on the other. It weighs from 1 1/2 to 3 1/2 pounds.



3. MIXING MORTAR:

a. Ingredients: Mortar is made using Cement, Lime, Sand and Water. Two types of cement can be used:

(1) Masonry cement: which has the lime already added in the appropriate proportions.

(2) Portland cement: which will require the addition of lime when mixing begins.

(3) Water quality: Water for mortar must meet the same requirements as water for concrete. Do not use water containing large amounts of dissolved salts. Salts will cause efflorescence (salt crystallization on the surface) and weaken the mortar.

b. Ratio: If Masonry Cement is used the ratio will be one part masonry cement and three parts sand. If Portland cement is used in place of Masonry cement the mix ratio is one part cement, three quarter parts lime, and four parts sand.

c. Machine mixing. Mix large quantities of mortar in a drum type mixer like a concrete mixer. Minimum mixing time is 3 minutes. Place all dry ingredients in the mixer first and mix them for 1 minute before adding water.

d. Hand mixing. Mix with the same tools you mixed concrete. Take care to mix all ingredients thoroughly to obtain a uniform mixture. As in machine mixing, **mix all dry materials together first before adding water**. Add water until desired consistency, usually the mortar mix will stick to the trowel or palm of the hand upside down. Keep a steel drum of water close to the box to use as the water supply. A second container of water to store clean shovels and hoes in when not in use.

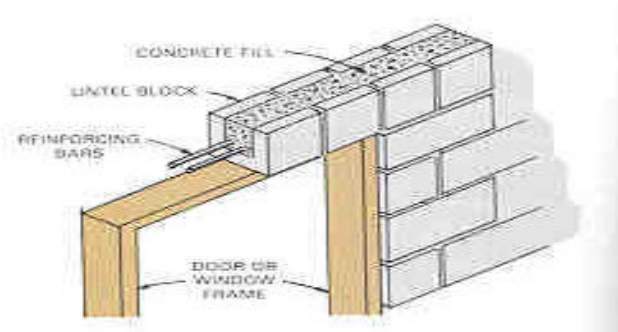
e. Re-tempering mortar. You can restore the workability of any mortar that stiffens on the mortarboard due to evaporation by remixing it thoroughly. Add water as necessary, but discard any mortar stiffened by initial setting. A practical guide is to use mortar within 2 1/2 hours after the original mixing when the air temperature is 80 degrees or higher, and within 3 1/2 hours when the temperature is below 80 degrees. Discard any mortar you have not used within these limits.

4. WALL CONSTRUCTION:

a. Reinforcement: Some block structures will have specifications requiring the structure to be tied into the foundation for added strength or some other method to provide strength. Below are the methods used.

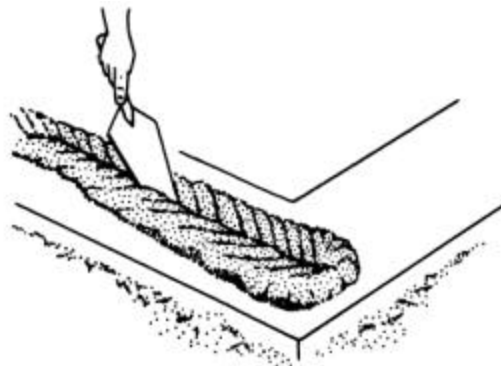
(1) ReBar: Provides lateral support. Reinforcement bars built into the foundation spaced anywhere between 2 to 4 feet apart and the block core they run through will be filled with concrete. It will run from the foundation to the top course. This is done in four course lengths, when the fourth course is laid another 4 course length of ReBar will be tied to the first piece. This is continued to the top course of the block.

(2) Bond beam: Provides horizontal support. This is accomplished by running one entire course made up of 8" lintel blocks which will have two rods of RebBar running through them and be filled with concrete. As shown below.



(a) If bond beams are used they are placed as the 4th, 8th, and 13th course of a block structure.

b. Laying first course: Once the layout is satisfactory move the loose blocks and lay a full bed of mortar. Using a trowel to spread and furrow the mortar to ensure there is plenty of mortar under each first course block.

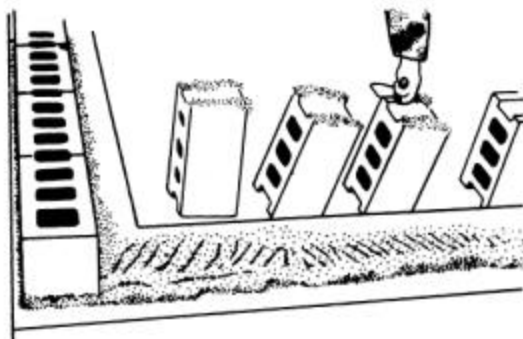


2. Spreading and Furrowing Mortar Bed

(1) A common trowel is usually triangular in shape, ranging in sizes of 3-6 inches long and 2-3 inches wide up to 11 inches long and from 4 to 8 inches wide. Its length and weight depends on the mason's preference. Generally, short, wide trowels are best, because they do not put too much strain on the wrist.

(2) Always start with a corner block and pay particular attention to ensure it is properly aligned, because all other blocks will be plumbed and leveled to it.

(3) Apply mortar to the ends of the succeeding blocks for the vertical joints. This is done by BUTTERING the blocks. As shown below blocks are placed on end and the mortar is applied with a trowel.



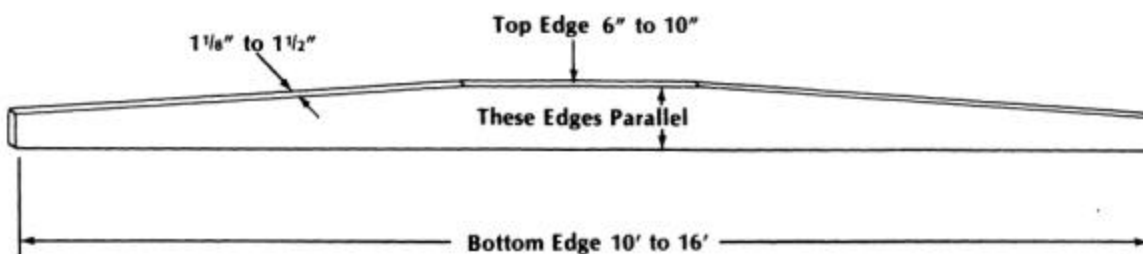
4. Buttering Blocks for Vertical Joints

(4) When placing blocks Ensure the blocks are laid with the thicker side up to provide a larger mortar bedding for the next course. Place each block with the buttered end facing the previously laid block and push it down vertically into the mortar bed and push it against the previously laid block to obtain a well-filled 3/8-inch mortar joint.

(5) Use the level to ensure each block is level and plumb. Use the handle of the trowel to tap the blocks if corrections are needed.



(6) After laying three to four blocks use the level, if it is long enough, to check block alignment. If the level is too short use a fabricated straight-edge, shown below, to extend the level's length. The level is placed on the top edge that is 6 to 10 inches in length.



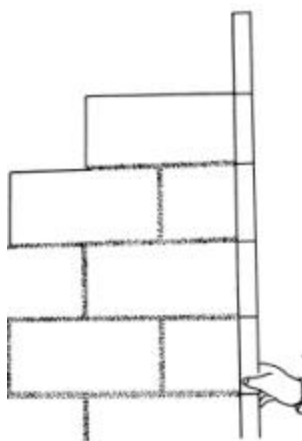
(7) Use these steps for the entire first course and it will be properly aligned level and plumb. This will ensure that the succeeding courses and the final wall are both straight and true.

c. Laying up the corners. After laying the first course, build up the corners of the walls, usually four or five courses high.

(1) Step back each course one half block. For the horizontal joints, apply mortar only to the tops of the blocks already laid. For the vertical joints, you can apply mortar either to the ends of the new block or the end of the block previously laid, or both, to insure well filled joints. As you lay each course at the corners, use a level to align, level, and plumb each block.



Carefully check each block with a level or straightedge to make sure that all the block faces are in the same plane to insure true, straight walls. A story or course pole, which is a board with a marking every 8 inches apart helps accurately determine the top of each masonry course.



Also check the horizontal block spacing by placing a level diagonally across the corners of the block.



d. Laying stretcher block between corners. When filling in the walls between the corners, first stretch a mason's line along the exterior block edges from corner to corner for each course. Then lay the top outside edge of each new block to this line. How you grip a block before laying it is important. First, tip it slightly toward you so that you can see the edge of the course below. Then place the lower edge of the new block directly on the edge of the blocks comprising the course below. Make all final position adjustments while the mortar is soft and plastic. Any adjustments you make after the mortar stiffens will break the mortar bond and allow water to penetrate. Level each block and align it to the mason's line by tapping it lightly with a trowel handle.

e. Closure block The closure block is the last stretcher block laid between the corners of each course. Before installing the closure block, butter both edges of the opening and all four vertical edges of the closure block with mortar. Then, lower the closure block carefully into place, as shown below.

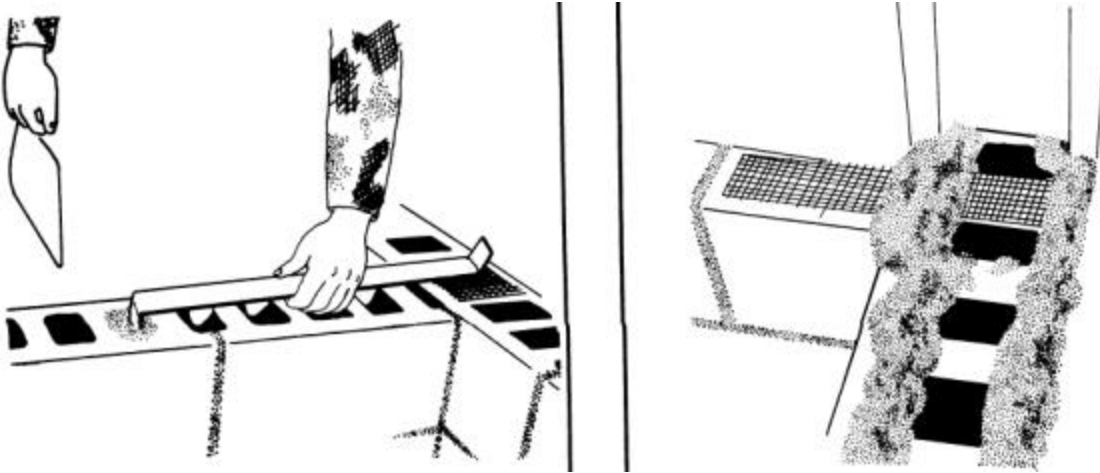


If any mortar falls out, leaving an open joint, remove the block and repeat the procedure.

f. Intersecting Walls: There are two types of intersecting walls Bearing and Non-load Bearing.

(1) Bearing walls: Does not tie into another wall it terminates at the face of that wall and is connected to it by using Z shaped tie bars. Z bars are 28 inches long and have 2-inch right angles on each end as shown below on the left.

(2) Non-Bearing walls: Are similar to load bearing walls but use metal lathing instead of a Z Bar. As shown below on the right.

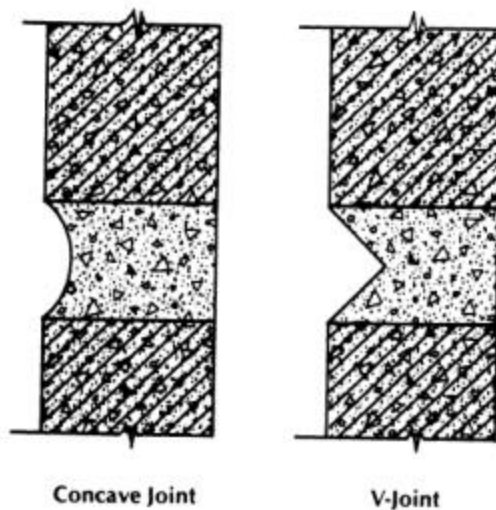


g. Mortar joints. To assure a good bond, do not spread mortar too far ahead of actually laying blocks, or it will stiffen and lose its plasticity. The recommended width of mortar joints for concrete masonry units is approximately $\frac{3}{8}$ inch thick which when properly made helps to produce a water tight, neat, and durable concrete masonry wall. As you lay each block, cut off excess mortar extruding from the joints using a trowel and throw it back on the mortarboard to rework into the fresh mortar. **Do not** rework any dead mortar from the scaffold or floor.

5. FINISHING

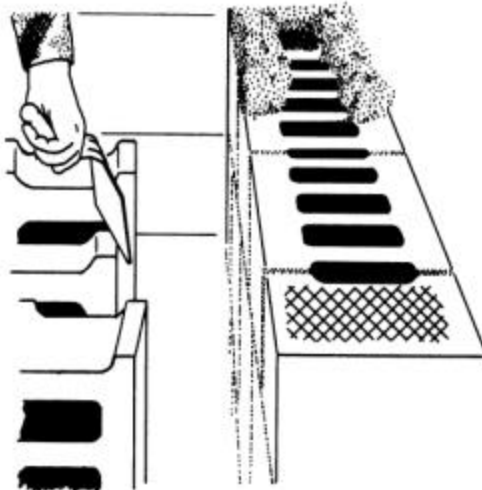
a. Tooling. Weather-tight joints and the neat appearance of concrete masonry walls depend on proper tooling. After laying a section of the wall, tool the mortar joint when the mortar becomes "thumbprint" hard. Tooling, sometimes referred to as striking, compacts the mortar and forces it tightly against the masonry on each side of the joint to make a water-tight joint. Use either concave or V-shaped tooling on all joints. A jointer and the Concave and V-shaped joints it makes are shown below





Tool vertical joints first, followed by striking the horizontal joints with a long jointer. Trim off mortar burrs from the tooling flush with the wall face using a trowel, soft bristle brush, or by rubbing with a burlap bag.

b. Anchor bolts. You must prepare in advance for installing wood plates on top of hollow concrete masonry walls with anchor bolts. To do this, place pieces of metal lathe in the second horizontal mortar joint from the top of the wall under the cores that will contain the bolts.



Use anchor bolts 1/2 inch in diameter and 18 inches long. Space them not more than 4 feet apart. When you complete the top two courses then fill the cores with concrete or mortar. The metal lath underneath holds the concrete or mortar filling in place. The threaded end of the bolt should extend above the top of the wall.

References:

1. FM 5-742, Concrete and Masonry
2. TM 5-704, Construction Print Reading in the Field
3. NAVPERS 10648-F, Rate Training Manual, Basic construction techniques for house and small buildings